

Manufacturing-Friendly Advance Seen in CIGS Solar Cell Processing

NREL scientists develop robust, high-performance IZO transparent contact for CIGS solar cells.

The standard transparent conducting oxide (TCO) used as the top contact in NREL's record-efficient copper indium gallium diselenide (CIGS) solar cell is zinc oxide (ZnO). The problem is that unprotected ZnO degrades rapidly (within hours) in damp heat testing.

NREL scientists previously demonstrated that amorphous indium zinc oxide (a-IZO) is essentially inert in damp heat testing, remaining unchanged after 40 days. In 2010, CIGS cells using a-IZO as the top contact demonstrated efficiencies equivalent to those of the standard ZnO-finished control cells. The a-IZO transparent contact was deposited by sputtering at ambient temperatures—a scalable commercial deposition process.

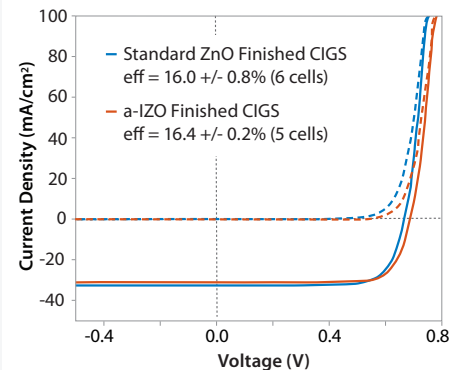
Moisture-induced degradation of CIGS thin-film PV is a lifetime-limiting problem that is currently addressed solely through encapsulation. Fundamentally improving the humidity resistance of the bare CIGS cell itself could yield increased product lifetimes or enable the use of cheaper, lighter encapsulation methods. Either one of these improvements would reduce costs and greatly improve product reliability.

An added benefit is that a transparent contact layer based on a-IZO could be deposited at low temperatures (<200°C), thus avoiding damage to the underlying CIGS layer. Demonstration of a highly environmentally resistant TCO with excellent conductivity, transparency, and water resistance would enable stable modules. The use of a-IZO meets all of these requirements with no decrease in CIGS PV efficiency.

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References: J.D. Perkins, T. Gennett, J.E. Leisch, R. Sundaramoorthy, I.L. Repins, M.F.A.M. van Hest, D.S. Ginley. "Amorphous Transparent Conductors for PV Applications." *Proceedings of the 35th IEEE Photovoltaic Specialist Conference*, 989-991 (2010).

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Efficiency profiles are virtually identical for solar cells finished with a-IZO vs. ZnO.

Key Research Results

Achievement

NREL scientists developed an amorphous InZnO transparent contact that should improve humidity resistance in CIGS solar cells.

Key Result

This new method yields increased product lifetimes and enables the use of cheaper, lighter encapsulation methods.

Potential Impact

These manufacturing-friendly improvements can reduce costs and improve product reliability.